



## Technical Service Bulletin

January 2002, TSB 138.01

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### Modified HYDRAcap<sup>®</sup> System Design for Industrial Applications.

This Technical Service Bulletin provides information for new improved system design on full-scale plants with HYDRAcap<sup>®</sup> ultrafiltration modules.

#### General

Reducing capital expenditure while maintaining process design is major goal for system design engineers. Simple modifications in piping, valves and control can save a substantial amount of money without compromising the operating modes of a HYDRAcap<sup>®</sup> system. The design recommendations described below discuss various ways to reduce capital expenditure.

**NOTE:** *The design modifications listed below may not be suitable for municipal applications. It is up to the design engineer to determine acceptability of proposed modifications.*

#### Forward Flush

Usually forward flush is performed with feed water at 40gpm flow per module. However, this flow is almost two times higher than the filtrate flow for the largest HYDRAcap<sup>®</sup> module. Thus, in order to achieve the necessary increase in flow for the forward flush, the feed pump must be increased in size (up to 80%). For a system with multiple racks, when one rack is forward flushing and the others remain in service, it is necessary for a quick increase in feed flow to accommodate the forward flush. Using feed water rather than filtrate to forward flush slightly improves recovery, but significantly increases the size of the feed pump, screen inlet filters, feed piping, valves and thus, capital cost.

Since the duration of the forward flush is relatively short, the benefit of using filtrate to forward flush will typically more than offset the decrease in recovery, which is usually less than 1%. Using filtrate water for the forward flush has the benefit of displacing the feed water residing in the module, this may enhance the subsequent backwash steps. The modifications to the system involve adding piping and valves from the backwash pump discharge to the bottom feed header inlet of each HYDRABLOC. Drawing No.: UFPA406 illustrates the HYDRABLOC P&ID for utilizing the backwash pump for forward flushing.

Drawing No.: UFPA407 illustrates the system P&ID for utilizing the backwash pump for forward flushing.

### **Recycle Loop**

Another costs saving option for systems that incorporate filtrate water for backwashing, and operate in crossflow mode, is to utilize the backwash pump in place of a separate crossflow pump. In order to implement the use of the backwash pump for crossflow it will be necessary to have a dedicated backwash loop for every HYDRABLOC. Thus, economic feasibility should be determined first. To use the backwash pump to generate crossflow will require connecting the top concentrate line of HYDRABLOC to the suction side of the backwash pump – drawing No.:UFPA407 illustrates the P&ID. Additional automatic control valves will also be required to isolate the backwash loop from the recycle loop. This will enable the pump to support crossflow and backwashing by programming the PLC to control the valve sequences and variable frequency drive.

One disadvantage is that the additional piping creates a potential bypass of the membrane barrier, and thus, a potential for direct contamination of the filtrate. However, when designed properly, the risk of filtrate contamination would be quite low. The use of double valve isolation with a drain valve in between reduces the risk of leaks between feed and filtrate. When working in crossflow during processing, a small part of discharge and suction line on the backwash pump is filled with feed water. The forward flush step should remove this potential contaminant.

### **Valve Sequences**

The PLC valve sequence table is listed below.

Valve FV-201 will be closed 75% of the time during clean in place (CIP). The chemical dosing pumps for coagulant and oxidant may not be necessary in some systems. An entry with (1/0) indicates optional usage based on system operation.

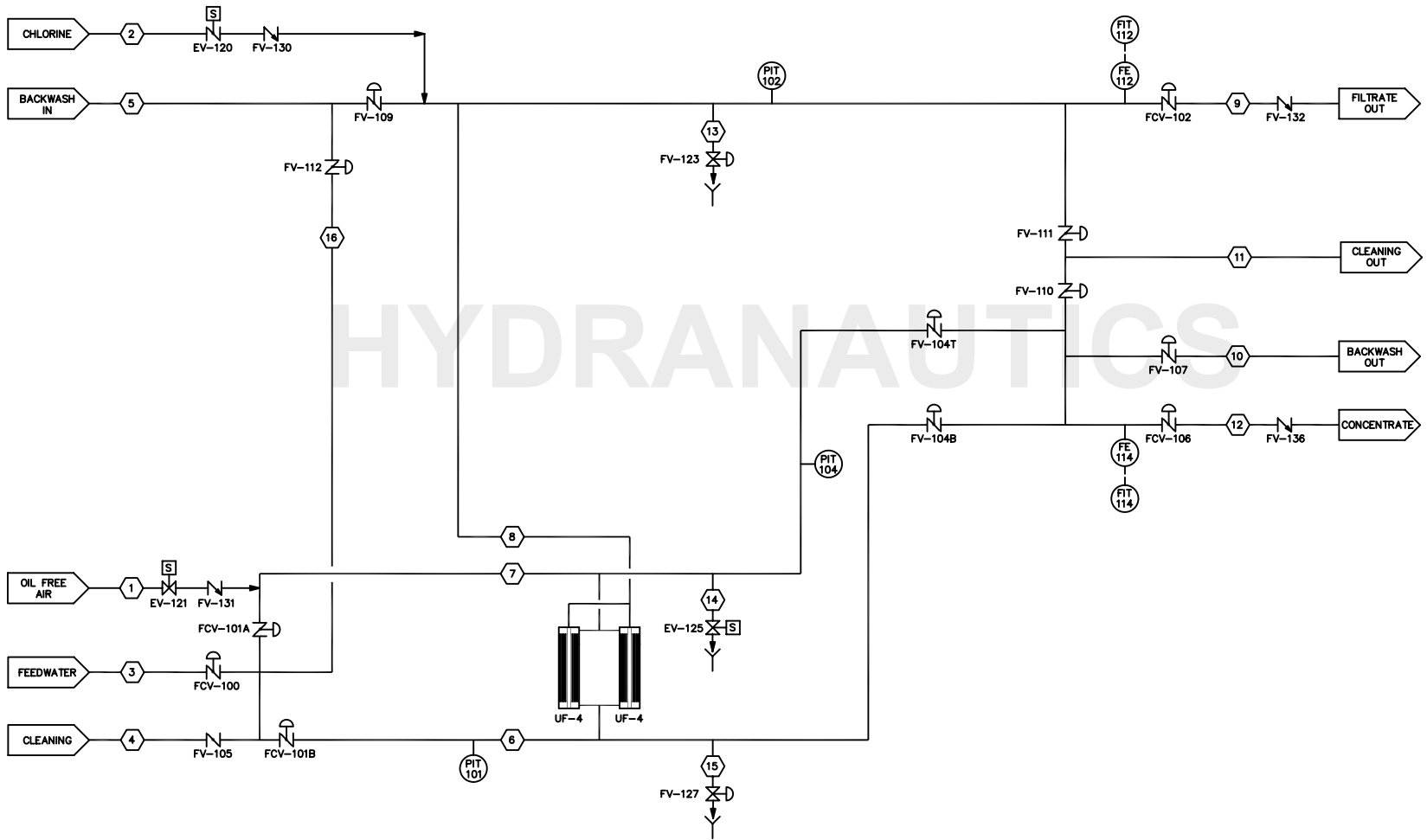
	Processing Bottom feed Dead end	Processing Cross Flow Recycle mode	Air pressurization	Forward Flush	Backwash Bottom	Backwash Top	Soak	Integrity Test	CIP
FCV-100	1	1	0	0	0	0	0	0	0
FV-102	1	1	1	0	0	0	0	1	1/0
FCV-101A	0	0	0	0	0	0	0	0	0
FCV-101B	1	1	0	1	0	0	0	0	1
FV-104T	0	1	0	1	0	1	0	0	1
FV-104B	0	0	0	0	1	0	0	0	0
FV-105	0	0	0	0	0	0	0	0	1
FV-106	0	1	0	0	0	0	0	0	0
FV-107	0	0	0	1	1	1	0	0	0
FV-109	0	0	0	0	1	1	0	0	0
FV-110	0	0	0	0	0	0	0	0	1
FV-111	0	0	0	0	0	0	0	0	1
FV-112	0	1	0	1	0	0	0	0	0
EV-120	0	0	0	0	1	1	0	0	0
EV-121	0	0	1	0	0	0	0	1	0
FCV-210	0	0	0	1	1	1	0	0	0
FCV-212	0	0	0	0	1	1	0	0	0
FCV-221	0	1	0	0	0	0	0	0	0
FCV-223	0	1	0	0	0	0	0	0	0
P-201	1	1	0	0	0	0	0	0	0
P-210	0	1	0	1	1	1	0	0	0
P-230	0	0	0	0	1/0	1/0	0	0	0
P-241	1/0	1/0	0	0	0	0	0	0	0

## System Parameters

All backwash fluxes are the same as those listed in HYDRAcap<sup>®</sup> specification sheets. Backwash time durations may be adjusted for optimization. Since feed water contaminates the backwash pump during cross flow mode, the duration of forward flush (FF) may need to be prolonged to ensure complete rinsing of the feed water from that part of the backwash line, that is shared for recycle/cross flow loop.

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STREAM NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
MAX. FLOW gpm	1 cfm	20 ppm	560	120	320	480	480	320	112	320	120	480	100	10	100	352				
PRESSURE psi	20	40	25	20	25	25	25	35	20	25	15	20	5	5	5	25				
PIPE SIZE inches		1/2	6	3	4	6	6	4		4	3	6	2	1	2	4				
MATERIAL	316SST	SCH 80 PVC	SCH 80 PVC	SCH 80 PVC	SCH 80 PVC	316SST	316SST	316SST	SCH 80 PVC	SCH 80 PVC	SCH 80 PVC	SCH 80 PVC	SCH 80 PVC	SCH 80 PVC	SCH 80 PVC	SCH 80 PVC				

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE: 1. PLATE DIMS. ± 0.005 IN. 2. DIMS. ± 0.010 IN. 3. HOLE DIMS. ± 0.005 IN. 4. HOLE DIMS. ± 0.010 IN. 5. HOLE DIMS. ± 0.015 IN. 6. HOLE DIMS. ± 0.020 IN.		DOCUMENT STATUS	REV.
DO NOT SCALE		DATE	DATE
DESIGN: R.L.		HYDRANAUTICS Oceanside, California U.S.A.	
APPROVED:		TITLE 8-40" MODULES HYDRACAP UF HYDRABLOC PROCESS FLOW DIAGRAM	
SPECIAL INSTRUCTIONS: INDUSTRIAL APPLICATION WITH FILTRATE FORWARD FLUSH		SIZE: DRAWING NO. 1-31-02R.L. D	REV. UFP4406 -
SHEET	FILE: UFP4406S1	SCALE	SHEET 1 OF 1

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REVISIONS	LTR	DESCRIPTION	DATE	BY	APPROVED

T-204  
FERRIC CHLORIDE TANK OR  
CHLORINE DIOXIDE INJECTION

P-241A/B  
PREDOSING PUMPS

P-201A/B/C  
FEEDWATER PUMPS

F-200A/B/C  
SELF CLEANING FILTERS  
150 MICRON

HYDRABLOC  
NO. 1

P-210A/B  
BACKWASH  
SUPPLY PUMPS

T-201  
FILTRATE COLLECTION  
TANK

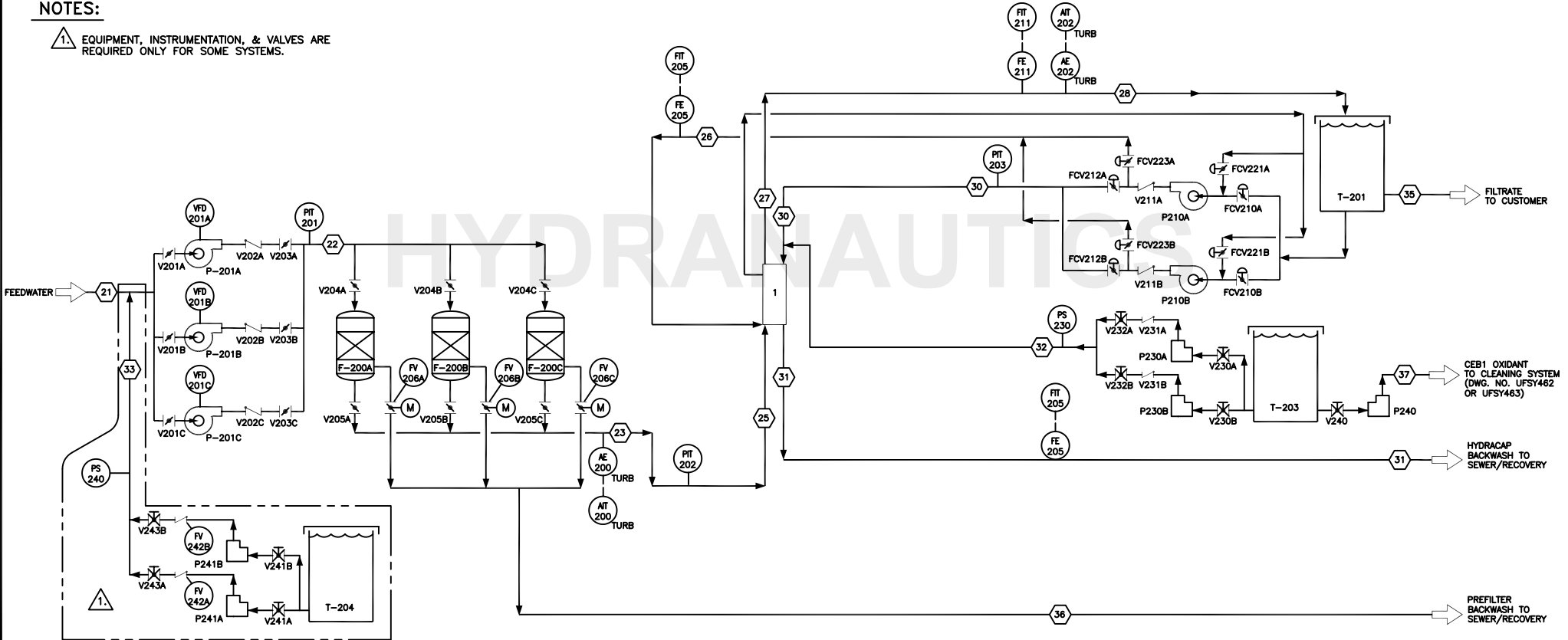
P-230A/B  
CEB1 OXIDANT  
DOSING PUMPS

P-240  
CEB1 OXIDANT  
TRANSFER PUMP

T-203  
CEB1 OXIDANT  
TANK

**NOTES:**

1. EQUIPMENT, INSTRUMENTATION, & VALVES ARE REQUIRED ONLY FOR SOME SYSTEMS.



STREAM NO.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
MAX FLOW gpm																					
MAX FLOW m <sup>3</sup> /hr																					
PRESSURE psi																					
PRESSURE bar																					
PIPE SIZE inches																					
MATERIAL																					

DO NOT SCALE	
DRAWN R.J.L.	DATE 1-23-02
CHECKED	
APPROVED	
SINGLE RACK DESIGN	
1-31-02R.J.L.	
WEIGHT	FILE UFPA4071

**HYDRANAUTICS**  
Oceanside, California U.S.A.

TITLE  
**HYDRACAP U.F. DISTRIBUTION PROCESS FLOW DIAGRAM INDUSTRIAL APPLICATION**

SIZE DRAWING NO. REV  
C **UFPA407** -

SCALE NONE SHEET 1 OF 1